



## [Translation of European Patent 0036822]

5 The present invention relates to the fitting-out of public transport rail, road, air, sea vehicles and, by corollary, transit areas.

It applies, in particular, the techniques disclosed by the applicant in his patents, particularly in France, namely patent No. 71/26437 of 20 July 1971 and its addition No. 71/38309 of 25 October 1971, and  
10 patent No. 77/27816 of 14 September 1977.

These known techniques consist mainly in at least one series of modules, which are transverse or longitudinal with the respect to the axis of the vehicle, each module containing a set of elongate  
15 seats, of reclining or even couched profile, each occupying 100% of the length of the module, whose width in plan view decreases evenly towards the foot end, these seats, superposed on four levels in particular, and accessible from the side via a corridor fitted with  
20 a ladder, being arranged head to toe on each level in juxtaposed pairs, and also head to toe from one level to the next, the mutual isolation of these seats being supplemented firstly by an angled central partition which, on each level, separates the said juxtaposed  
25 seats and carries pockets to take the inside elbows, and secondly, by walls which close the ends of the module.

In the particular case of a railway carriage, whether this be of the transverse type with  
30 compartments closed by sliding doors, or of the longitudinal type, the said known techniques also relate to the cylindrical washrooms, the luggage storage, the equipment cupboards, the access corridors and the access doors in particular.

35 These known techniques display numerous advantages including the paradoxical and main advantage of affording both a greater number of elongate seats and greater overall comfort for each of them, in a limited volume. The term "overall comfort" is to be

RECEIVED

APR 10 2003

GROUP 3600

understood as meaning not only the comfort of the seats but also the ability to satisfy all the successive needs of each. The said elements therefore collaborate closely in an inseparable way to obtain the said  
5 paradoxical main advantage which is the only one which is important.

There do, however, remain a number of imperfections which the present invention remedies. For example, the said seats have three drawbacks. Firstly,  
10 their manufacture differs according to whether they are on an odd level or an even level. Secondly, being elongate, spanning 100% in one piece, their structure is relatively thick. Thirdly, their outline in plan view is an asymmetric right-angled trapezium which is  
15 ill suited to the human form.

According to a first characteristic of the invention, each elongate seat over 100% of the length of the module is divided transversely into three portions, namely a main central portion representing  
20 approximately 70% and taking the torso and legs, which is inserted between a portion representing approximately 15% which takes the head and a portion representing approximately 15% which takes the feet, the said central portion, when viewed in plan, having  
25 the shape of a symmetric trapezium which, in the finished state, is identical across one and the same level and from one level to another, hence forming a first interchangeable series; as the head portion before padding is a simple asymmetric quadrilateral  
30 flat panel which is identical across one and the same level, and inverted from one level to another laterally, side for side, it therefore forms a second series which is interchangeable in the bare state; the same is true of the foot portion which forms a third  
35 series which is interchangeable in the bare state. The finishing, padding, covering and attachments, of each of these two series of bare panels differs according to the level, that is to say according to which side is

being used, but this diversity does not in any way complicate their manufacture.

Other features of the invention will become apparent in the course of the description which will follow, which is given merely by way of example.

Figs. 1 and 2 are plan views of a pair of elongate seats 3, 4 juxtaposed head to toe, divided at 7, 5, 12 and 8, 6, 11, according to the invention, into longitudinal modules (Fig. 1) and transverse modules (Fig. 2).

Fig. 3 is a section through a railway carriage of the transverse type, with a fixed ladder 46 in a compartment 37.

Fig. 4 is the plan view of the vertical stiffeners 57, 26, 58 and of the support plates T, P, according to Fig. 3.

Fig. 5 is a plan view of Fig. 3.

Fig. 6 is a plan view of one end of a railway carriage, with two cylindrical washrooms 70, 71 and equipment cupboards 76, 77.

Figs. 7 to 10 are, in profile and face-on, an articulated ladder 84, as an alternative to the fixed ladder 46 of Figs. 3, 5 and 6.

Figs. 11 to 13, which are in profile, are an articulated central portion 102.

Fig. 14 is an alternative form of Fig. 5, with a central transverse passage 116, opening to two additional access doors 117, 118.

Fig. 15 is a cylindrical alternative form of the stiffeners of Fig. 4.

Fig. 1 shows the rectangular layout 1 of a module 2 184 cm long and about 90 cm wide, containing, at each level, two elongate seats 3, 4 head to toe, each divided into three portions, namely, two identical central portions 5, 6 with a reclining profile and which, viewed in plan, have the shape of symmetric trapezia of angle  $\alpha$  of 20 degrees; two identical inclined flat head panels 7, 8 with a space 9, 10 for the heads; and two inclined flat foot panels 11, 12,

which are also identical. The joints between the three portions are along, on the one hand, two separate horizontal lines 13, 14 and, on the other hand, two distinct horizontal lines 15, 16.

5           The angled central partition 17 separates the juxtaposed seats with flat vertical portions which, at each level, make, with the central plane 18, an angle  $\alpha$  of 20 degrees, the direction of which alternates from one level to the next.

10           These seats, divided at 7, 5, 12 and 8, 6, 11 are identical from one level to the next, and in each level they can coincide through a rotation of 180 degrees about the central vertical axis 19 of the module.

15           The central partition 17 has pockets 20, with a depth  $b$  of 10 cm, to take the inner elbows. Each pocket 20, with a height  $c$  of 13 cm, located between the two reclining section pieces 21, 22 can be seen in Fig. 3. Dividing the seats into three reduces the span of the  
20   central portion to 70%, thus reducing the thickness of its structure, so that its 5 cm thickness in the clad state, can be reduced to 3 cm. Two simultaneous advantages in ensue: firstly, the 2 cm reduction in the vertical spacing  $h$  of the levels for the same occupant  
25   comfort, which, through a cumulative effect, contributes to the creation of a fifth level 30, 31 (Fig. 3) inside the regulatory size 33; and secondly, the 2 cm increase in the height  $c$  of the pockets 20. It will be noted that an increase in the height of the  
30   luggage storage spaces 47, 48 and 49 equal to this same vertical spacing  $h$  corresponds to these two additional spaces 30, 31, 10 instead of 8 per compartment 37.

          It can be seen in the longitudinal module 2 of Fig. 1, that the external outline of the feet protrudes  
35   beyond the outline 1 by 10 cm, as shown by hatching at 23, 24. This overhang would not be possible in a transverse module 2', Fig. 2, because it would narrow both the entry and the end of the compartment 37 by  $2 \times 10 = 20$  cm. Hence, Fig. 2 shows the same central

portions 5, 6 as in Fig. 1, but after a pivoting  $\alpha$  of about 4 degrees about the aforementioned axis 19, and the partition 17 now simply makes an angle  $\alpha'$  of  $20 - 4 = 16$  degrees with this same mid-plane 18 of the module. As a result of this, the aforementioned overhangs of 10 cm on the four verticals of the four corners of the module are replaced by overhangs which are reduced to 3.5 cm, spread across eight verticals, namely the aforementioned ones at the four corners, and four more intermediate verticals which leave the middle of the flanks of the module intact, that is to say without overhang, at the location of the access ladders 46. The head panels, 7', 8' and foot panels 11', 12' (Fig. 2) differ from those 7, 8, 11, 12 of Fig. 1 because of the said 4-degree rotation.

Fig. 3 shows the lateral corridor 34, with diversionary fold-up aisle seats 35 and nets 36, then a half compartment 37' and its four seats 38, 39, 40, 41 head to toe respectively with the other four 42, 43, 44, 45 of the adjacent compartment located behind the central partition. It also shows the fixed central vertical ladder 46, and the various luggage storage spaces namely 47, 48 at the end on the left, 49 above the corridor, and 50 right at the top, and finally under the seats 38, 42 at floor level.

The said superposed and divided seats are fixed to the two ends of the module by the walls 51, 52 and 55, 56 which are stiffened by the vertical angle section pieces 53, 54, 57, 58 at the corners and the trapezoidal central section pieces 25, 26, all these section pieces being secured to head-end plates T and foot-end plates P (Fig. 4), four per level, namely T2, T'2 and P2, P'2 in the case of the head panel 8' and foot panel 12' of level 2 drawn in Fig. 2.

Likewise, T1, T'1, P1, P'1; T3, T'3, P3, P'3; T4, T'4, P4, P'4; respectively for the other levels 1, 3 and 4.

In Fig. 3 only the plates T1, P1; T2, P2; T3, P3 and T4, P4 can be seen. All these plates support the

said head or foot panels such as 8' or 12' via their upper edge faces 60, 61 and support the edges 15, 16 of the central portions 5, 6 via their end faces 62, 63.

5 The central section piece 25, outside the module, is inserted between the two sliding doors 27, 28, and the other one 26 stiffens the vertical partition 29 separating the adjacent compartments 37, at the end of these.

10 Fig. 5 again shows the details of Figs. 2 and 3, namely, the lateral corridor 34; the end walls 51, 52, 55, 56 stiffened by the central section pieces 25, 26 and corner section pieces 53, 54, 57, 58; the central partition 17 extended as far as the ends of the module; the partition 29; the internal corridors 64  
15 with their fixed ladders 46.

Fig. 6 shows one end of a railway carriage with a platform 65; doors 66 between carriages; doors 67, 68 for access to the station platform; washrooms 70, 71, advantageously two of these, namely four per carriage,  
20 symmetric to the longitudinal plane 69, with cylindrical walls and doors 72, 73; lateral corridor 34; swing door 74; and the corridor returning round the other side as a dead end 75 to access the toilet (71) on the other side to the corridor (34); and finally the  
25 equipment cupboards 76 at the head of the toilets 70, 71 and also at the end 77 of the said dead end 75.

The cavities and lumps of the local protrusions at the four levels of the half module 81 are married with the lumps and cavities of the basins 82, 83 so as  
30 to improve on compactness without affecting user comfort.

Replacing the fixed vertical ladders 46 of Figs. 3, 5 and 6 with the articulated ladder 84 of Figs. 7 to 10, which has two positions inclined by  
35 about 10 degrees, makes it possible to reduce appreciably the width of the internal corridors of the compartments 37, for example by over 10 cm for at least the same level of ease of moving the feet, hips and shoulders along it, use of the ladder also being made

easier by its inclination. This cumulative saving contributes to the creation of an additional compartment. In Figs. 7 and 8, in profile and face-on, the articulated ladder 84 pivots about an axis 85  
5 located in the mid-plane of the internal corridor 86, this axis preferably being under the floor 87 of the carriage.

The lower part of the ladder consists of one or two stiff flat bars 88, the extensions 89 of which  
10 slide in the hollows of the uprights 90 of the ladder 84, the top of which is articulated about an axis 91 parallel to the axis 85, with a sleeve 92 carrying one or two rings 93, 94 which, depending on the direction of tilting arrowed 95, 96, drop into and lock in one of  
15 the two recesses 97, 98, or upper flats made at the two ends of a longitudinal tube 99 fixed under the bow of the roof 100. The ladder is lightweight. It can be unlocked by lifting it up by hand.

A gasket 101 accompanying the foot of the flat  
20 bars 88 covers the recess in the floor 87 in the travel of the ladder.

Fig. 9 is an enlarged view of the top of the ladder 84.

Fig. 10 is an alternative form of the axis 85,  
25 the flat or flats 88 here being secured to a cylinder 85' rotating between two pairs of rollers 85'', the imaginary axis of rotation advantageously being well below the floor level.

Figs. 11 to 13 show, in profile, the three  
30 horizontal and substantially transverse axes of rotation of the central portion 102 of the seats, namely 103 at the head end, 104 at the bottom of the reclining profile, and 105 at the foot end, with a twin sliding link of the tubes 106 in their sleeves 107. The  
35 balls 108 pressed by the spring 109 wedge automatically against the cone 110 and lock the compensation spring 111 under the weight of the body. The balls 108 can be unjammed using the pull cord 112, with a lever 113 in reach of the hand, or of the foot, actuating the part

114 via the opposing spring 115, provided the body curls slightly, and therefore only when the occupant so wishes.

5 Fig. 14 depicts, in a railway carriage of the transverse type with a single lateral corridor 34, a central transverse passage 116 opening to two additional sliding access doors 117, 118, with their housings 119, 120. This reduces the mean interior path between access doors 117, 67 or 118, 68 and seats  
10 almost by half. This passage 116, with at least the same number of seats, is obtained by the aforementioned saving that is due to the ladders 84, and through the reduction of the platforms 65, because traffic is partly diverted through the new doors 117 or 118.

15 The angled outlines of the two half modules 121, 122 can be covered and supplemented with equipment cupboards, not drawn.

With an odd number of compartments, the said passage 116 can be inserted between two half  
20 compartments 37' each closed by a lateral wall and lateral door, these again being cylindrical, and not drawn, including the ladder.

Fig. 15, as an alternative form of Figs. 2 to 6, depicts, at each end of the modules, a vertical  
25 support structure made up in halves of two cylindrical walls 123, 124 and 125, 126, therefore already rigid per se as a result of this, but further strengthened locally, particularly by portions of triangular vertical section pieces, alternating from one stage  
30 127, 128 to the other 129, 130, which do not impinge on the volumes actually used, as they are each located in a dead space.

It is also notable that these cylindrical walls 123, 124 and 125, 126 practically maintain the volume  
35 of the living space because their vertical axes are at the intersections 131 or 132 of the vertical planes of symmetry of the central portions 5, 6 which are common to the various levels.



The compartments are equipped with cylindrical sliding doors which are coaxial in the closed position 133, 134 or open position 135, 136.

5 The result of this is a further saving on used space. Already the stiffened simple walls 51, 52 and 55, 56 replacing conventional partitions 2 cm thick have allowed a saving of almost 4 cm in the width of the carriage. In addition, replacing the flat walls 51, 10 52, 55, 56 with cylindrical walls 123, 124, 125, 126 which do not make the living space smaller at the end of the compartments 37, on the one hand, gives an almost 2 cm increase in the thickness used for luggage storage spaces 47, 48 thanks to their wider access openings 137, 138 and, alongside the lateral corridor 15 34, on the other hand, gives a gain of about 3 cm in the width of the carriage, by dispensing with the 4 cm section piece 25 and replacing the thick flat doors 27, 28 with slim cylindrical doors 135, 136.

Furthermore, the rounded shape of these doors 20 means that when the doors are closed 133, 134 the corridor 34 becomes wider at this point 139, which occurs repeatedly at short intervals, making passing easier.

Note that with the central doors 117, 118, the 25 lower framework of the carriage narrows at the lateral discontinuities thus created, in order to respect the continuity of the longitudinal structure.

Note too that the lowermost profile of the articulated central portion 102 corresponds to those of 30 Fig. 3. Nobody can therefore disturb his neighbour, variations occurring within one's own volume.

Finally, to top the feeling of high overall comfort, it will be noted that the aesthetics of each device is always combined with its function as 35 described in the foregoing description, namely the elongate seats themselves which are double head to toe, the support plates, the cylindrical doors and walls of the compartments, the articulated reclining profile that gives a more or less couched position, the

articulated ladder whose use at an incline is easier and is easier to get past, the cylindrical walls and doors of the four washrooms, the fifth level and the central passage which reduces the path inside with hand luggage almost by half.

There are two details to be noted. Firstly, the elongate seats with a reclining profile and a width that decreases towards the foot end, double head to toe, reduce the individual volume by half for the same level of bodily comforts: 0.75 high with four stages instead of three, 0.75 wide with  $60 + 30 = 90$  cm instead of  $60 + 60 = 120$  cm, and 0.91 long with 184 cm for a developed size of 202 cm. Now,  $0.75 \times 0.75 \times 0.91 = 0.51$ .

Secondly, the cylindrical wall of the washrooms focuses and superposes the three functional areas S1, S2, S3 used respectively for entering/exiting, using the toilet and using the basin, thus dispensing with (S2 + S3) with each of the three aforementioned successive functions retaining their level of comfort.

The foregoing description confirms the extent to which all the component parts of the vehicle, apparently disparate, do actually collaborate closely through their dimensions, their number and/or their shapes, to yield this paradoxical important result, namely that of both improving the overall comfort offered to each traveller and increasing the number of travellers in the same unchanged volume.

**New arrangement for fitting out transit areas and  
vehicles**

A vehicle layout comprising at least one series of modules (2') each containing a set of elongate seats (3, 4) with a reclining or even couched profile, each occupying 100% of the length of the module, the width of which decreases towards the foot end, these seats, which are superposed on several levels and accessible from the side via a corridor (64) with a ladder (46), being arranged top to toe on each level and top to toe from one level to the other, characterized in that each seat is divided transversely into three portions, namely a main central portion (5, 6) representing about 70%, which, viewed in plan, is a symmetrical trapezium which is interchangeable in the finished state, inserted between two asymmetrical padded flat panels for the head and for the feet (7', 8') and (11', 12') respectively, these representing approximately 15% each and being interchangeable in the bare state.